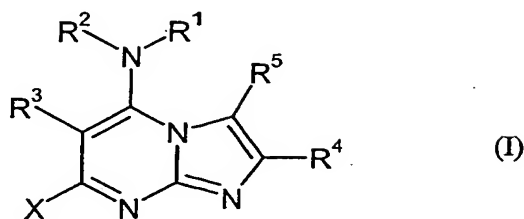


Claims

1. Imidazolopyrimidines of the formula (I),



in which

- 5 R^1 represents H, R^2 , optionally substituted alkyl, optionally substituted alkenyl, optionally substituted alkynyl, optionally substituted cycloalkyl or represents optionally substituted heterocyclyl,
- R^2 represents an organic radical which contains 3 to 13 carbon atoms and one or more silicon atoms and also, if appropriate, 1 to 3 identical or different heteroatoms from the group consisting of oxygen, nitrogen and sulphur and which is
- 10 unsubstituted or substituted by 1 to 4 identical or different halogens, or
- R^1 and R^2 together with the nitrogen atom to which they are attached represent an optionally substituted heterocyclic ring which contains one or more silicon atoms and/or is substituted by one or more radicals R^2 ,
- 15 R^3 represents optionally substituted aryl, optionally substituted heterocyclyl, optionally substituted alkyl, optionally substituted alkenyl, optionally substituted alkynyl, optionally substituted cycloalkyl, optionally substituted aralkyl, halogen, or an optionally substituted amino group, optionally substituted (C₁-C₈)-alkoxy, optionally substituted (C₁-C₈)-alkylthio, optionally substituted (C₆-C₁₀)-aryloxy, optionally substituted (C₆-C₁₀)-arylthio, optionally substituted heterocyclloxy, optionally substituted (C₆-C₁₀)-aryl-(C₁-C₄)-alkoxy, optionally substituted (C₆-C₁₀)-aryl-(C₁-C₄)-alkylthio, optionally substituted heterocyclyl-(C₁-C₄)-alkoxy, or optionally substituted heterocyclyl-(C₁-C₄)-alkylthio;
- 20 R^4 represents H, halogen, optionally halogen-substituted alkyl or optionally halogen-substituted cycloalkyl;
- 25 R^5 represents H, halogen, optionally halogen-substituted alkyl or optionally halogen-substituted cycloalkyl; and

X represents halogen, cyano, optionally substituted alkyl, optionally substituted alkoxy or optionally substituted phenyl,

and salts thereof.

2. Imidazolopyrimidines of the formula (I) according to Claim 1 in which

5 R¹ represents H, or

R¹ represents a radical R², or

10 R¹ represents alkyl having 1 to 6 carbon atoms which may be mono- to pentasubstituted by identical or different substituents from the group consisting of halogen, cyano, hydroxy, alkoxy having 1 to 4 carbon atoms and cycloalkyl having 3 to 8 carbon atoms, or

R¹ represents alkenyl having 2 to 6 carbon atoms which may be mono- to trisubstituted by identical or different substituents from the group consisting of halogen, cyano, hydroxy, alkoxy having 1 to 4 carbon atoms and cycloalkyl having 3 to 8 carbon atoms, or

15 R¹ represents alkynyl having 3 to 6 carbon atoms which may be mono- to trisubstituted by identical or different substituents from the group consisting of halogen, cyano, alkoxy having 1 to 4 carbon atoms and cycloalkyl having 3 to 8 carbon atoms, or

20 R¹ represents cycloalkyl having 3 to 8 carbon atoms which may be mono- to trisubstituted by identical or different substituents from the group consisting of halogen and alkyl having 1 to 4 carbon atoms, or

25 R¹ represents saturated or unsaturated heterocyclyl having 3 to 8 ring members and 1 to 3 heteroatoms, such as nitrogen, oxygen and/or sulphur, where the heterocyclyl may be mono- or disubstituted by halogen, alkyl having 1 to 4 carbon atoms, cyano and/or cycloalkyl having 3 to 8 carbon atoms,

30 R² represents an aliphatic saturated or unsaturated group having 1 to 13 carbon atoms and one or more silicon atoms which optionally contains 1 to 3 identical or different heteroatoms from the group consisting of oxygen, sulphur and nitrogen and which is unsubstituted or substituted by 1 to 4 identical or different halogen atoms, or

R¹ and R² together with the nitrogen atom to which they are attached represent a saturated or unsaturated heterocyclic ring having 3 to 8 ring members which contains one or more silicon atoms and/or is substituted by one or more radicals R², where the heterocycle may contain a further nitrogen, oxygen or sulphur atom as ring member and where the heterocycle may furthermore be substituted up to three times by fluorine, chlorine, bromine, alkyl having 1 to 4 carbon atoms and/or haloalkyl having 1 to 4 carbon atoms and 1 to 9 fluorine and/or chlorine atoms;

R³ represents C₁-C₁₀-alkyl, C₂-C₁₀-alkenyl, C₂-C₁₀-alkynyl, C₃-C₈-cycloalkyl or phenyl-C₁-C₁₀-alkyl, where R³ is unsubstituted or partially or fully halogenated and/or optionally carries one to three radicals from the group R^X, or C₁-C₁₀-haloalkyl which optionally carries one to three radicals from the group R^X, and R^X represents cyano, nitro, hydroxy, C₁-C₆-alkyl, C₁-C₆-haloalkyl, C₃-C₆-cycloalkyl, C₁-C₆-alkoxy, C₁-C₆-haloalkoxy, C₁-C₆-alkylthio, C₁-C₆-haloalkylthio, C₁-C₆-alkylsulphinyl, C₁-C₆-haloalkylsulphinyl, C₁-C₆-alkylsulphonyl, C₁-C₆-haloalkylsulphonyl, C₁-C₆-alkylamino, di-C₁-C₆-alkylamino, C₂-C₆-alkenyl, C₂-C₆-alkenyloxy, C₂-C₆-alkynyl, C₃-C₆-alkynyloxy and optionally halogenated oxy-C₁-C₄-alkyl-C₁-C₄-alkenoxy, oxy-C₁-C₄-alkenyl-C₁-C₄-alkoxy, oxy-C₁-C₄-alkyl-C₁-C₄-alkyloxy,

R³ represents phenyl which may be mono- to tetrasubstituted by identical or different substituents from the group consisting of

halogen, cyano, nitro, amino, hydroxy, formyl, carboxy, carbamoyl, thiocarbamoyl;

in each case straight-chain or branched alkyl, alkoxy, alkylthio, alkylsulphinyl or alkylsulphonyl having in each case 1 to 6 carbon atoms;

in each case straight-chain or branched alkenyl or alkenyloxy having in each case 2 to 6 carbon atoms;

in each case straight-chain or branched haloalkyl, haloalkoxy, haloalkylthio, haloalkylsulphinyl or haloalkylsulphonyl having in each case 1 to 6 carbon atoms and 1 to 13 identical or different halogen atoms;

in each case straight-chain or branched haloalkenyl or haloalkenyloxy having in each case 2 to 6 carbon atoms and 1 to 11 identical or different halogen atoms;

in each case straight-chain or branched alkylamino, dialkylamino, alkylcarbonyl, alkyl-carbonyloxy, alkoxycarbonyl, alkylsulphonyloxy, hydroximinoalkyl or alkoximinoalkyl having in each case 1 to 6 carbon atoms in the individual alkyl moieties;

cycloalkyl having 3 to 8 carbon atoms;

5 1,3-propanediyl, 1,4-butanediyl, methylenedioxy (-O-CH₂-O-) or 1,2-ethylenedioxy (-O-CH₂-CH₂-O-), attached in the 2,3 position, where these radicals may be mono- or polysubstituted by identical or different substituents from the group consisting of halogen, alkyl having 1 to 4 carbon atoms and haloalkyl having 1 to 4 carbon atoms and 1 to 9 identical or different halogen atoms;

10 or

R³ represents saturated or unsaturated heterocyclyl having 3 to 8 ring members and 1 to 3 heteroatoms from the group consisting of nitrogen, oxygen and sulphur, where the heterocyclyl may be mono- or disubstituted by halogen, alkyl having 1 to 4 carbon atoms, alkoxy having 1 to 4 carbon atoms, alkylthio having 1 to 4 carbon atoms, haloalkoxy having 1 to 4 carbon atoms, haloalkylthio having 1 to 4 carbon atoms, cyano, nitro and/or cycloalkyl having 3 to 6 carbon atoms;

or

20 R³ represents C₁-C₈-alkylamino, C₂-C₈-alkenylamino, C₂-C₈-alkynylamino, di-C₁-C₈-alkyl-amino, di-C₂-C₈-alkenylamino, di-C₂-C₈-alkynylamino, C₂-C₈-alkenyl-(C₂-C₈)-alkynyl-amino, C₂-C₆-alkynyl-(C₁-C₈)-alkylamino, C₂-C₈-alkenyl-(C₁-C₈)-alkylamino, C₆-C₁₀-aryl-amino, C₆-C₁₀-aryl-(C₁-C₈)-alkylamino, C₆-C₁₀-aryl-(C₁-C₄)-alkyl-(C₁-C₈)-alkylamino, heterocyclyl-(C₁-C₈)-alkylamino or heterocyclyl-(C₁-C₄)-alkyl-(C₁-C₈)-alkylamino;

25 R⁴ represents H, halogen, (C₁-C₄)-alkyl which is unsubstituted or substituted by one or more halogen atoms, cyclopropyl which is unsubstituted or substituted by one or more halogen atoms;

R⁵ represents H, halogen, (C₁-C₄)-alkyl which is unsubstituted or substituted by one or more halogen atoms, cyclopropyl which is unsubstituted or substituted by one or more halogen atoms; and

30 X represents H, fluorine, chlorine, bromine or CN.

3. Imidazolopyrimidines of the formula (I) according to Claim 1 or 2 in which

R^1 represents hydrogen, methyl or ethyl;

R^2 represents a group $Y^2-Si(O_mCH_3)(O_nCH_3)(O_pY^3)$,

where m, n and p independently of one another represent 0 or 1;

5 Y^2 represents a bond or alkanediyl, alkenediyl or alkynediyl which are in each case straight-chain or branched, have 1 to 6 and 2 to 6 carbon atoms, respectively, are optionally interrupted by one or two non-adjacent oxygen atoms and are unsubstituted or substituted by 1 to 3 identical or different halogen atoms; and

10 Y^3 represents straight-chain or branched alkyl or alkenyl having 1 to 5 and 2 to 5 carbon atoms, respectively, optionally interrupted by an oxygen, nitrogen or sulphur atom and unsubstituted or substituted by 1 to 3 identical or different halogen atoms;

R^3 represents (C_1-C_8) -alkyl, (C_1-C_8) -cycloalkyl, benzyl or

R^3 represents phenyl which may be mono- to trisubstituted by identical or different substituents from the group consisting of

15 fluorine, chlorine, bromine, cyano, nitro, formyl, methyl, ethyl, n- or i-propyl, n-, i-, s- or t-butyl, allyl, propargyl, methoxy, ethoxy, n- or i-propoxy, methylthio, ethylthio, n- or i-propylthio, methylsulphinyl, ethylsulphinyl, methylsulphonyl, ethylsulphonyl, allyloxy, propargyloxy, trifluoromethyl, trifluoroethyl, difluoromethoxy, trifluoromethoxy, difluorochloromethoxy, trifluoroethoxy, difluoromethylthio, difluorochloromethylthio,
20 trifluoromethylthio, trifluoromethylsulphinyl, trifluoromethylsulphonyl, trichloroethynyloxy, trifluoroethynyloxy, chloroallyloxy, iodopropargyloxy, methylamino, ethylamino, n- or i-propylamino, dimethylamino, diethylamino, acetyl, propionyl, acetyloxy, methoxycarbonyl, ethoxycarbonyl, hydroximinomethyl, hydroximinoethyl, methoximinomethyl, ethoximino-
25 methyl, methoximinoethyl, ethoximinoethyl, cyclopropyl, cyclobutyl, cyclopentyl or cyclohexyl,

1,3-propanediyl, 1,4-butanediyl, methylenedioxy $(-O-CH_2-O-)$ or 1,2-ethylenedioxy $(-O-CH_2-CH_2-O-)$, attached in the 2,3-position, where these radicals may be mono- or polysubstituted by identical or different substituents from the group consisting of fluorine, chlorine, methyl, ethyl, n-propyl, i-propyl and/or trifluoromethyl,

- R^3 represents pyridyl which is attached in the 2- or 4-position and may be mono- to tetrasubstituted by identical or different substituents from the group consisting of fluorine, chlorine, bromine, cyano, nitro, methyl, ethyl, methoxy, methylthio, hydroximinomethyl, hydroximinoethyl, methoximinomethyl, methoximinoethyl and/or trifluoromethyl, or
- 5 R^3 represents pyrimidyl which is attached in the 2- or 4-position and may be mono- to trisubstituted by identical or different substituents from the group consisting of fluorine, chlorine, bromine, cyano, nitro, methyl, ethyl, methoxy, methylthio, hydroximinomethyl, hydroximinoethyl, methoximinomethyl, methoximinoethyl and/or trifluoromethyl, or
- 10 R^3 represents thienyl which is attached in the 2- or 3-position and may be mono- to trisubstituted by identical or different substituents from the group consisting of fluorine, chlorine, bromine, cyano, nitro, methyl, ethyl, methoxy, methylthio, hydroximinomethyl, hydroximinoethyl, methoximinomethyl, methoximinoethyl and/or trifluoromethyl, or
- R^3 represents C_1 - C_8 -alkylamino or di- C_1 - C_8 -alkylamino, or
- 15 R^3 represents thiazolyl which is attached in the 2-, 4- or 5-position and may be mono- or disubstituted by identical or different substituents from the group consisting of fluorine, chlorine, bromine, cyano, nitro, methyl, ethyl, methoxy, methylthio, hydroximinomethyl, hydroximinoethyl, methoximinomethyl, methoximinoethyl and trifluoromethyl, or
- 20 R^3 represents N-piperidiny, N-tetrazolyl, N-pyrazolyl, N-imidazolyl, N-1,2,4-triazolyl, N-pyrrolyl, or N-morpholinyl which are in each case unsubstituted or mono- or - if possible - polysubstituted by identical or different substituents from the group consisting of fluorine, chlorine, bromine, cyano, nitro, methyl, ethyl, methoxy, methylthio, hydroximinomethyl, hydroximinoethyl, methoximinomethyl, methoximinoethyl and trifluoromethyl,
- R^4 represents H, Cl, F, CH_3 , $-CH(CH_3)_2$ or cyclopropyl;
- 25 R^5 represents H, Cl, F, CH_3 , $-CH(CH_3)_2$ or cyclopropyl; and
- X represents H, F, Cl, CN, (C_1-C_4) -alkyl which is unsubstituted or substituted by one or more fluorine or chlorine atoms.
4. Imidazolopyrimidines of the formula (I) according to one or more of Claims 1 to 3 in which
- 30 R^1 represents H;

R^2 represents SiMe_3 , SiMe_2Et , $\text{SiMe}_2\text{CHMe}_2$, $\text{SiMe}_2\text{CH}_2\text{CHMe}_2$, $\text{SiMe}_2\text{CH}_2\text{CMe}_3$, $\text{SiMe}_2\text{OCHMe}_2$, $\text{SiMe}_2\text{OCH}_2\text{CHMe}_2$, CH_2SiMe_3 , $\text{CH}_2\text{SiMe}_2\text{Et}$, $\text{CH}_2\text{SiMe}_2\text{CHMe}_2$, $\text{CH}_2\text{SiMe}_2\text{CH}_2\text{CHMe}_2$, $\text{CH}_2\text{SiMe}_2\text{OMe}$, $\text{CH}_2\text{SiMe}_2\text{OCHMe}_2$, $\text{CH}_2\text{SiMe}_2\text{OCH}_2\text{CHMe}_2$, CHMeSiMe_3 , $\text{CHMeSiMe}_2\text{OMe}$, $(\text{CH}_2)_2\text{SiMe}_3$, $(\text{CH}_2)_2\text{SiMe}_2\text{Et}$, $(\text{CH}_2)_2\text{SiMe}_2\text{CHMe}_2$, $(\text{CH}_2)_2\text{SiMe}_2\text{CMe}_3$, $(\text{CH}_2)_2\text{SiMe}_2\text{CH}_2\text{CHMe}_2$, $(\text{CH}_2)_2\text{SiMe}_2\text{CH}_2\text{CH}_2\text{Me}$, $(\text{CH}_2)_2\text{SiMe}_2\text{CH}_2\text{CMe}_3$, $(\text{CH}_2)_2\text{SiMe}_2\text{OCHMe}_2$, $(\text{CH}_2)_2\text{SiMe}_2\text{OCH}_2\text{CHMe}_2$, $\text{CHMeCH}_2\text{SiMe}_3$, $\text{CHMeCH}_2\text{SiMe}_2\text{Et}$, $\text{CHMeCH}_2\text{SiMe}_2\text{CH}_2\text{CH}_2\text{Me}$, $\text{CHMeCH}_2\text{SiMe}_2\text{CHMe}_2$, $\text{CHMeCH}_2\text{SiMe}_2\text{CMe}_3$, $\text{CHMeCH}_2\text{SiMe}_2\text{CH}_2\text{CHMe}_2$, $\text{CFMeCH}_2\text{SiMe}_3$, $\text{CHMeCH}_2\text{CH}_2\text{SiMe}_2\text{OMe}$, $\text{CHMeCH}_2\text{SiMe}_2\text{OCHMe}_2$, $\text{CHMeCH}_2\text{SiMe}_2\text{OCH}_2\text{CHMe}_2$, $\text{CH}_2\text{CHMeSiMe}_3$, $\text{CH}_2\text{CHMeSiMe}_2\text{Et}$, $\text{CH}_2\text{CHMeSiMe}_2\text{CHMe}_2$, CHMeCHMeSiMe_3 , $\text{CMe}_2\text{CH}_2\text{SiMe}_3$, $(\text{CH}_2)_3\text{SiMe}_3$, $(\text{CH}_2)_3\text{SiMe}_2\text{Et}$, $(\text{CH}_2)_3\text{SiMe}_2\text{CHMe}_2$, $(\text{CH}_2)_3\text{SiMe}_2\text{CH}_2\text{CHMe}_2$, $(\text{CH}_2)_3\text{SiMe}_2\text{OMe}$, $(\text{CH}_2)_3\text{SiMe}_2\text{OCHMe}_2$, $(\text{CH}_2)_3\text{SiMe}_2\text{OCH}_2\text{CHMe}_2$, $\text{CHMeCH}_2\text{CH}_2\text{SiMe}_3$, $\text{CHMeCH}_2\text{CH}_2\text{SiMe}_2\text{Et}$, $\text{CHMeCH}_2\text{CH}_2\text{SiMe}_2\text{CHMe}_2$, $\text{CHMeCH}_2\text{CH}_2\text{CH}_2\text{SiMe}_2\text{OMe}$, $\text{CHMeCH}_2\text{CH}_2\text{SiMe}_2\text{OCHMe}_2$, $\text{CMe}=\text{CHSiMe}_3$, $\text{CH}_2\text{CH}_2\text{SiMe}_2\text{OMe}$, $-\text{C}\equiv\text{C}-\text{SiMe}_3$, $-\text{CH}_2-\text{C}\equiv\text{C}-\text{SiMe}_3$ or $-\text{CHMe}-\text{C}\equiv\text{C}-\text{SiMe}_3$;

R^3 represents (C_1-C_6) -alkyl, (C_3-6) -alkenyl, (C_3-C_6) -alkynyl, (C_3-C_8) -cycloalkyl, where R^3 is unsubstituted or substituted by one or more fluorine or chlorine atoms,

or

R^3 represents 2,4- or 2,6-disubstituted phenyl or represents 2-substituted phenyl or represents 2,4,6-trisubstituted phenyl,

R^3 represents pyridyl which is attached in the 2- or 4-position and which may be mono- to tetrasubstituted by identical or different substituents from the group consisting of fluorine, chlorine, bromine, cyano, methyl, ethyl, methoxy, methylthio, hydroximinomethyl, hydroximinoethyl, methoximinomethyl, methoximinoethyl and trifluoromethyl, or

R^3 represents pyrimidyl which is attached in the 4-position and may be mono- to trisubstituted by identical or different substituents from the group consisting of fluorine, chlorine, bromine, cyano, methyl, ethyl, methoxy, methylthio, hydroximinomethyl, hydroximinoethyl, methoximinomethyl, methoximinoethyl and trifluoromethyl;

R^4 represents H, $-\text{CH}_3$, $-\text{CH}(\text{CH}_3)_2$, Cl or cyclopropyl;

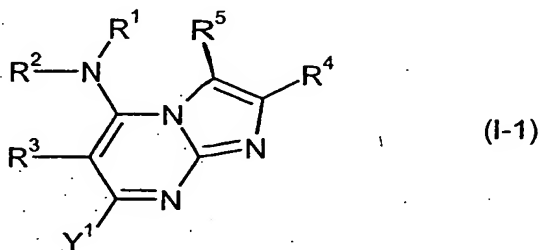
R^5 represents H, $-\text{CH}_3$, $-\text{CH}(\text{CH}_3)_2$, Cl or cyclopropyl; and

X represents fluorine, chlorine, (C₁-C₇)-alkyl or (C₁-C₃)-haloalkyl.

5. Process for preparing imidazolopyrimidines of the formula (I) according to one or more of Claims 1 to 4, where

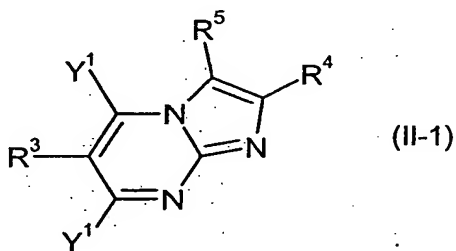
(Process (a))

- 5 imidazolopyrimidines of the formula (I-1), in which Y¹ represents halogen



and the other symbols are as defined in formula (I) in Claim 1,

are obtained by reacting haloimidazolopyrimidines of the formula (II-1),

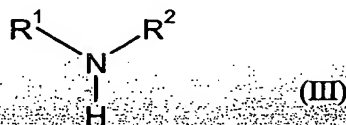


- 10 in which

R³, R⁴, R⁵ are as defined above and

Y¹ represents halogen

with amines of the formula (III),



- 15 in which

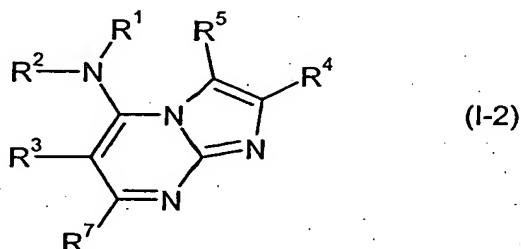
R¹ and R² are as defined above,

if appropriate in the presence of a diluent, if appropriate in the presence of an acid acceptor and if appropriate in the presence of a catalyst,

or

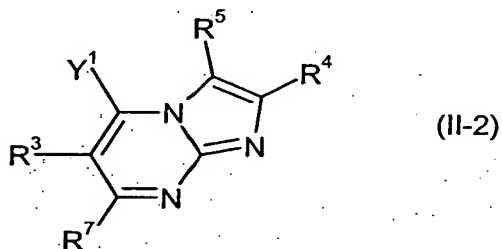
(Process (b))

- 5 imidazolopyrimidines of the formula (I-2), in which R^7 represents optionally substituted alkyl or optionally substituted phenyl



and the other symbols are as defined in formula (I) in Claim 1,

are obtained by reacting haloimidazolopyrimidines of the formula (II-2),



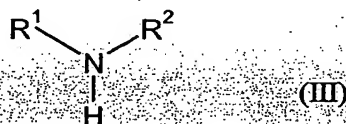
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in which

R^3, R^4, R^5 are as defined above and

Y^1 represents halogen and R^7 represents optionally substituted alkyl or optionally substituted phenyl

- 15 with amines of the formula (III)



in which

R^1 and R^2 are as defined above,

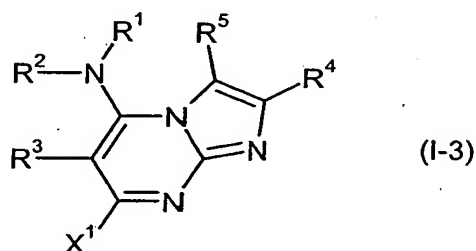
if appropriate in the presence of a diluent, if appropriate in the presence of an acid acceptor and if appropriate in the presence of a catalyst,

or

5

(Process (c))

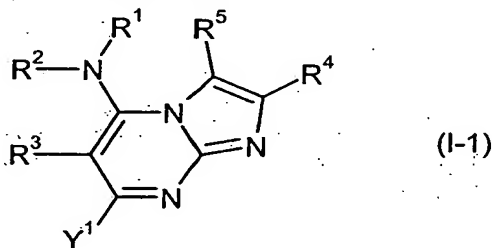
imidazolopyrimidines of the formula (I-3), in which X^1 represents cyano or optionally substituted alkoxy



and the other symbols are as defined in formula (I) in Claim 1,

10

are obtained from the imidazolopyrimidines, mentioned above, of the formula (I-1),



where Y^1 represents halogen and the other symbols are as defined above,

by reaction with a compound of the formula $M-X^1$ (IX),

in which the cation M represents ammonium, tetraalkylammonium, an alkali metal or an alkaline earth metal and in which

15

X^1 represents cyano, alkoxy or substituted alkoxy.

6. Composition for controlling unwanted microorganisms, characterized in that it comprises at least one imidazolopyrimidine of the formula (I) according to one or more of Claims 1 to 4, in addition to extenders and/or surfactants.

7. Composition according to Claim 6, characterized in that it comprises at least one further agrochemically active compound.
8. Use of imidazolopyrimidines of the formula (I) according to one or more of Claims 1 to 4 for controlling unwanted microorganisms.
- 5 9. Method for controlling unwanted microorganisms, characterized in that imidazolopyrimidines of the formula (I) according to one or more of Claims 1 to 4 are applied to the unwanted microorganisms and/or their habitats.
10. Process for preparing compositions for controlling unwanted microorganisms, characterized in that imidazolopyrimidines of the formula (I) according to one or more of
10 Claims 1 to 4 are mixed with extenders and/or surfactants.

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